ART. XXXVI.—*An Introduction to the Study and Collection of the Araneidea in New Zealand. With a Description and Figures of* Cambridgea fasciata, *L. Koch, from Chatham Island; and also of a New Species of* Macrothele, *Auss.*, M. huttonii, *Cambr., found at Wellington, New Zealand.* By the Rev. O. P. CAMBRIDGE, M.A., C.M.Z.S.

Plate VI.

[*Read before the Wellington Philosophical Society, 22nd September,* 1873.]

I.—SYSTEMATIC POSITION AND GENERAL STRUCTURE.

THE *Araneidea*, or (as distinguished from other Arachnids) *true* spiders, are often popularly included under the general term of *Insects;* it will, therefore, not perhaps be amiss to begin with a diagram showing their position, both in relation to their nearer congeners as well as to the greater groups of the animal world.

ANIMAL KINGDOM.

Branch: i. Radiata, ii. Mollusca | iii. ARTICULATA, iv. Vertebrata.

Class: i. *Aphantopoda | ii. †Condylopoda.

Sub-class: i. Insecta, ii. Myriapoda, iii. ARACHNIDA | iv. Crustacea.

Order: i. Acaridea, ii. Phalangidea, iii. Solpugidea, iv. Scorpionidea | v. Thelyphonidea vi. ARANEIDEA.

Of the whole sub-class *Arachnida*, it will be sufficient to state here that its leading characters are, BODY *divided into two principal parts*—CEPHALOTHORAX and ABDOMEN; ORGANS OF LOCOMOTION, EIGHT; EYES, *when present*, TWO *to* TWELVE, *and simple; in some few cases absent altogether;* RESPIRATION *by means of* TRACHEÆ *or* PULMOBRANCHIÆ, or a *combination of the two.*

Order ARANEIDEA.

This order of the Arachnida is characterized—first, by an undivided cephalo-thorax, which yet shows, by its various converging grooves and furrows, more or less distinctly, the cephalic and thoracic segments (separate in the *Insecta*), of which it is the soldered-up result (Pl. VI., figs. 3, 4, and 16). The abdomen is united to the cephalo-thorax by a narrow pedicle, and terminates with organs for spinning; it is covered with a continuous epidermis, neither (as far as known) annulate, nor segmentate, nor folded, except in two remarkable species—*Liphistius desultor*, Schiödte, and (but partially only) in *Tetrablemma medioculata*, Cambr. Respiration is tracheal as well as pulmobranchial; the respiratory organs are placed underneath the fore extremity of the abdomen; their position is generally indicated by round or oval scale-like plates, and at the fore edge of each is an almost imperceptible slit or orifice, through which air is admitted to the breathing apparatus (f. 2*m*, and 15*m*).

* Comprising the *Annelides*.

† Corresponding to the *Insecta*, Linn., or *Condylopoda*, Latr.

In some of the Araneidea the spiracular plates are four in number (f. 15*m*, *n*), but for the most part there are only two; where more than two are present it has been found that the posterior pair are connected with *tracheæ*, the anterior ones with *pulmo-branchiæ*. In some few spiders a kind of supernumerary spiracular slit or opening is visible, near to the ordinary one, but not always similarly placed. *Cambridgea quadrifasciata*, L. Koch, as described below, is an instance of this, where, when the spider is looked at in profile (f. 3*p*), it is *above* the ordinary one on each side (see also post, description of Plate VI., f. 2*tt*).

The *Falces*, two in number (f. 5*d*, 16*d*, 3*x*), are one-jointed, and articulated beneath the fore part of the cephalo-thorax; they are generally armed, more or less, with teeth on their inner sides, and each terminates with a moveable curved fang, which, when not in use, is folded down either across the inner side of the extremity of the falx, as with most spiders (f. 5*d*), or backwards along its length as in one family—*Theraphosides* (f. 15*r*); by means of these fangs a poison secreted within the caput is instilled into the wound made by them, proving, no doubt, fatal to the spider's prey, and often nearly so—in the genus *Lathrodectus*—to human beings; for instance, *Lathrodectus katipo*, Ll. Powell, *vide* Trans. N.Z. Inst., III., pp. 56–59; also, F. W. Wright, *id.*, II., pp. 81–84; and W. L. Buller, *id.*, III., pp. 29–34.

The *Eyes* (f. 12, 19)—as at present known—are two, four, six, or eight in number, but by far the larger proportion have eight eyes; two known species alone have four—*Miagrammopes*, Cambr., and *Tetrablemma*, *id.*—and only one species—*Nops*, Macleay—has yet been described with two; the eyes are variously disposed, but always symmetrically on the fore part of the caput—*i.e.*, the cephalic segment—which is generally well defined by an oblique indentation and constriction on either side of the anterior part of the cephalo-thorax (f. 3*r*, 4*b*, and 16*b*). The number and general position of the eyes form one valuable character for the formation of genera, while their relative size is strongly specific.

The *Legs*, eight in number, are articulated to a kind of separate plate (sternum, f. 2*f*, and 15*f*), which forms the underside of the cephalo-thorax; in one genus (*Miagrammopes*, Cambr.) from Ceylon, no sternum, properly so called, exists, the legs being articulated to the continuous underside of the cephalo-thorax.

Except in one or two species the legs are seven-jointed, and variously furnished with hairs, bristles, and spines, each tarsus ending with two or three claws, generally more or less bent or curved, and commonly pectinated, or finely denticulate; these claws are used as hooks, to give a tension to the lines of their snares by holding on and straining upon them. The spines and bristles also are, in many cases, used in the construction of the silken snares, in which spiders entrap their prey; and the males of some species have a

curious row of short closely-set curved spiny bristles along a portion of the upper side of the metatarsi of the fourth pair of legs. The use of this row of bristles (called the calamistrum) is alluded to further on.

The length of the legs in spiders is very various, both actually and relatively, and the differences between them, as well as their armature and terminal claws, furnish valuable characters, often generic and *always specifically* important (f. 10, 17).

The Palpi are two (in many species leg-like) limbs of five, or (counting the basal piece, to which each is articulated) six joints (f. 7, 8, 9). The basal piece, situated immediately behind the falces, forms a *maxilla* (f. 8*y*, and 9*y*) on either side of another piece, the *labium* (f. 2*h*, and 15*h*). This latter is various in form, and always present, except in a new and remarkable spider lately received from Brazil—*Aphantochilus*, Cambr.—in which the labium is wanting, the maxillæ in this instance closing up to each other. Within the labium is another portion of structure—the tongue—to which sufficient attention has not yet been paid by araneologists ; by the aid of this portion no doubt the act of swallowing the juices of insects, when expressed by the falces and maxillæ, is effected. These parts, *falces*, *maxillæ*, *labium*, and *tongue*, thus form the *mouth* of a spider. The *maxillæ* are various in form and size, and, with the labium and general disposition of the eyes, furnish the most tangible, if not the only reliable, characters for distinguishing the genera. The 3rd (cubital, f. 7*v*, 8*v*, 9*v*) and 4th (radial, f. 7*t*, 8*t*, 9*t*) joints of the palpi in the male are (the former often, the latter generally) characterized by prominences, spiny apophyses or protuberances, which furnish some of the strongest and most tangible specific characters in that sex (f. 7*tt*) ; in the female the palpi are simple and quite pediform, generally terminating with a single claw. The last (or digital) joint of each palpus (in the male spider) is generally more or less concave (f. 8*s*), including in its concavity a (sometimes complex) congeries of lobes, spines, and spiny processes (f. 8*o* and 18*o*) capable in some instances of being opened out as by hinges. These are not developed until the spider has come to maturity. Up to this period the digital joint has a tumid and somewhat semi-diaphanous appearance, and, although generally smaller, bears the same general form that it has after maturity.

That these processes, or, as they are termed, *palpal organs*, are intimately connected with the process of reproduction—the fecundation of the female spider—is certain ; but the mode of their efficiency can hardly be said to have been even yet satisfactorily determined. In the female the palpus terminates generally with a single claw, often pectinated ; instances, however, are frequent of the absence of any terminal palpal claw. Between the plates of the spiracles, and close to the fore-extremity of the abdomen on the under side, is placed the external aperture of the female generative organs ; this aperture

(vulva) is of various forms and sizes in different species. In connection with this aperture is frequently a peculiar corneous process—*epigyne* (f. 6*k*)—differing more or less in structure in almost every species yet known, and thus in most species furnishing a tangible and reliable specific character. In a similar situation is the external orifice (exceedingly minute) of the male seminal organs; no external or protrusive process has ever been observed to be connected with them. Experiments on the generation of spiders, made with great care by our distinguished araneologist, Mr. Blackwall ("Report on some recent researches into the structure, functions, and economy of the Araneidea,"—Report of Brit. Assoc., 1844, pp. 68, 69), go to prove conclusively that the seminal organs of the male spider (at least so far as any external use or application is concerned) are in some cases wholly unnecessary for the impregnation of the female, and this has led me to conjecture (hypothetically) that there may be some minute ducts connecting the seminal organs with the alimentary canal through which the fecundating fluid might pass to the œsophagus, and thus be taken from the mouth by the palpal organs. The discharge of the spermatic fluid in birds into the lower intestine, whence it is voided by the vent, has been mentioned to me by a scientific friend as a somewhat analogous case to what I have suggested. This idea has received some support (in fact it was raised first in my mind) by the repeated notice, in several species, of the constant application, by the male, of the digital joint of the palpus to the mouth, between the times of its application to the female organs. These applications were alternate and rapid, and very distinctly made, and no other use was made of the palpi during the whole process of copulation. The question as to the existence of such ducts, as I have supposed might exist between the male seminal organs and the alimentary canal, would be one well worth the attention of insect anatomists living in the tropics, where spiders of large size might easily be procured for dissection, and in adult males the presence of spermatozoa might be sought for in the œsophagus and mouth by means of the microscope. No European spider is perhaps large enough for such an investigation to be prosecuted with much chance of any certain result. Some arachnologists are of opinion that the male spider collects the seminal fluid with its palpal organs from the minute orifice above noted, but I am not aware of an instance in which any spider has been detected in such an employment of its palpi, either during the process of copulation or at any other time, nor, I believe, has any fluid ever been discovered in the palpi. Mr. Blackwall's opinion would seem to be that impregnation is wholly independent of the male seminal organs or of their contents, which is a position contrary to all reason and analogy; but whatever may be the real facts in regard to this, it is certain that the palpi and curious palpal organs of the male spider are actively used in copulation, and afford

good and tangible specific characters, most useful (in fact indispensable) in the determination of species, in many cases where form, colour, and other points of structure present but little reliable difference.* In one instance (*Lycosa andrenivora*, Bl.) I observed frequent acts of copulation (?) between an adult male and female, and in every act there was an embrace which brought the under part of the abdomen of each spider in contact with that of the other, forming a perfect apparent coition between the sexual apertures of the two; in this instance the palpi were not used at all.

An eminent Prussian arachnologist (Herr Menge) has based numerous genera on the form of the several portions of the male palpal organs; but the mere fact of these characters belonging to one sex only, appears conclusively fatal to their adoption as leading characters of genera. The *spinners* of spiders, situated as before observed (f. 2*o*, 15*o*, and 13*r*), are two, four, six, or eight in number, and usually placed in pairs; when a fourth pair is present it is

* At the time of writing the above I had not had an opportunity of seeing two papers by German araneologists, A. Menge (Ueber die Lebensw. d. Arachn., p. 36) and A. Ausserer (Beob. ueber die Lebensw. der Spinnen, p. 194, etc.), in which, as quoted by Dr. Thorell ("On European Spiders," p. 27, note 1), it is stated that "the male spider, before the act of copulation, emits from the sexual aperture, situated under the base of the abdomen, a drop of sperma on a kind of small web made for the purpose, which drop he then takes up in the genital bulb of the palpi."

If this be the usual *modus operandi*, it certainly seems strange that so painstaking and accurate an observer as Mr. Blackwall should never have seen it take place during at least forty years' observations "in the field." I certainly have not myself witnessed any such process, though in some few instances the *whole* act, apparently, of copulation, from its beginning to its conclusion, has come before me. Mr. Blackwall also, in a paper just come to hand (Proc. Lin. Soc., Vol. VII.), and entitled "*A succinct review of recent attempts to explain several remarkable facts in the physiology of Spiders and Insects*," alludes to Herr Menge's solution of the point in question, and also to a conjecture of M. Dugés, offered many years previously; and he mentions a fact observed by himself in reference to a male of *Agelena labyrinthica* which seems to support a part both of Dugés' conjecture and Menge's solution. Mr. Blackwall says that "a male of *Agelena labyrinthica*, confined in a phial, spun a small web, and among the lines of which it was composed I perceived that a drop of white, milk-like fluid was suspended; how it had been deposited there I cannot explain, but I observed that the spider, by the alternate application of its palpal organs, speedily imbibed the whole of it."

Since the above note was penned I have received the concluding part of Thorell's "Synonyms of European Spiders," in which (Part IV., pp. 591–595) Dr. Thorell reviews most of the above among other considerations upon this interesting subject. It appears that a German araneologist, Herman, of whose writings I was ignorant, had in 1868 concluded that there was some communication by a duct, or ducts, between the spermatic vessels in the abdomen and the palpal organs. This idea seems to be negatived by former anatomists (Dugés and others), who have failed to discover any duct *in the palpus*, where it should, if existant, be of comparatively easy discovery; but their failure to discover more than two flexuose vermicular spermatic vessels in the abdomen does not convince me that other—may-be excessively minute but efficient—ducts may not be there, and so connect these tubes (through the stalk which contains the alimentary canal, and joins the cephalo-thorax and abdomen) with the œsophagus, as mentioned above.

generally as a single one united throughout its whole length, and occupying a transverse position in front of the rest. It is but lately that spiders have been observed with *two* spinners only ("Spiders of Palestine and Syria," by O. P. Cambridge, Proc. Zool. Soc., 1872, p. 260; also, An. N. H., 1870, pp. 414–417, *ibid.*)

The spinners vary greatly in size and structure, as well as in number, but hitherto their use in classification has not been what one might have expected from so essential and important a portion of structure. The *fourth* pair of spinners, when present—which it is in both sexes—is correlated, but only in the female sex, with the peculiar double series of closely-set curved bristles (mentioned above) on the metatarsi of the fourth pair of legs. Mr. Blackwall has given the appropriate name of *calamistrum* to this series of bristles, and has proved that their function is to card or tease a peculiar kind of adhesive silk secreted and emitted from the fourth pair of spinners—the use of the silk is for disposal about the spider's snare, rendering the entanglement of its prey the more speedy and certain. Immediately above the spinners is a small nipple-like prominence, of greater or less size, which indicates the orifice of the anus (f. 15*p*).

As it does not enter into the design of this short introduction to go into the anatomical details of the Araneidea, it remains only to touch briefly upon their distribution and habits, and to make a few observations on their capture and mode of preservation.

It should, however, be noticed here that the sexes of spiders, though not generally presenting any *great* difference in size, yet in very many cases show it to an extreme extent. The male is nearly always the smallest, though its legs are often much the longest, but with many of the Epeïrides and Thomisides the male is scarcely more than an eighth or a tenth of the length of the female. This is a fact to be borne in mind, otherwise the male of many such spiders will be overlooked, or thought to be of a different species, while, if it is remembered, the collector may often have an opportunity of noting important circumstances in the economy of spiders which at first sight may seem to be unconnected with each other; and thus spiders now perhaps described as totally different species may be found to be the different sexes of the same.

In determining the species of spiders it is very convenient to obtain comparative dimensions from different portions of structure; thus the position of the eyes on the fore part of the caput furnishes us with the *facial space* (f. 5*e*, and 19*a*), and the *clypeus* (f. 3*n*, and 19*b*). The comparative extent of these parts is of great importance as a specific character, and they are of easy observation; that part of the facial space occupied by the eyes is concisely expressed by the "*ocular area*" (f. 3*o*).

II.—DISTRIBUTION AND HABITS.

Spiders are to be found more or less abundantly in every part of the world, and in almost every conceivable position; even subterranean caves, such as those of Adelsberg and the Island of Lesina, are tenanted by species peculiarly adapted, by the absence of eyes, to their dark and gloomy abodes. Less repulsive in appearance than most others of the Arachnida, the Araneidea are often extremely interesting in their habits. Being almost exclusively feeders on the insect tribes, they are consequently endowed with proportionate craftiness and skill; this is shown remarkably in the construction of their snares and dwellings, and though many live a vagabond life, and capture their prey without the aid of any snare, by merely springing upon it unawares, or, in some instances, running it fairly down in open view, yet craft and skill are equally apparent whatever be their mode of life and subsistence.

Spiders are oviparous, and the cocoons or nests in which many species enclose their eggs are very beautiful, as well as varied and characteristic in form. The geometric webs of the Epeïrides are a marvel of beauty and delicacy. The well-known but, as yet, very insufficiently studied nests of the "trap-door" spiders—*Cteniza*, *Nemesia*, etc.—strike even those who have the greatest aversion to spiders with wonder; and the egg cocoon of a not unfrequent spider in England, *Ero variegata*, could hardly fail to arrest the attention of the least concerned in natural history. This cocoon is of a pear shape, formed of strong silk net-work, of a yellow-brown colour, and attached to stems of dead grass, or sticks and other substances, in shady places, by a long elastic stem or pedicle of the same material; it is semi-diaphanous, and the eggs may be seen within like little seeds, but unattached to each other. From their mode of life spiders attain (as we should naturally suppose) their largest size, and are found in greatest profusion, in the tropical regions; while in more temperate climates, where the members of the insect tribes are smaller, and their species fewer, we find spiders in general of comparatively smaller dimensions and less numerous in species. The largest known spider—one of the family Theraphosides, found in Brazil, *Eurypelma klugii*, Koch—has an extent of legs equal to nine inches, with a body (cephalo-thorax and abdomen) of two and a-half or more inches in length; while the smallest known spider —*Walckenäera diceros*, Cambr., found in England—has a body of no more than one twenty-fifth of an inch in length. Tropical countries, however, although possessing the giants of the spider race, are far richer in minute species than has been generally supposed. I have received numerous species from Ceylon, measuring from one-twelfth to one-twentieth of an inch only in length.

To say that spiders are less repulsive in appearance than other Arachnida is to do them but scanty justice, for numbers of species of various genera,

notably amongst the jumping spiders (Salticides), are unsurpassed by insects of any order, in respect both to brilliancy of colouring and the designs formed by its distribution. Some of the curious and delicate little species of the genera *Argyrodes* and *Ariamnes* are perfect marvels of metallic brilliancy—one of the latter (yet undescribed) from Ceylon, has the abdomen of a delicate yellowish-buff hue, covered thickly with separate and nearly round spots or scales of a transparent kind of silvery substance, looking like a compound of silver and mother-of-pearl. Colours and markings, although at times liable to mislead, are yet nearly always specifically characteristic, and should therefore be carefully noted before they had faded, or, as is often the case in preserved specimens, run one into the other.

Besides their craft and skill, spiders are also very cleanly in their habits and persons. I have several times watched one of our common English Saltici—*Calliethera histrionica*, Koch—engaged for many minutes in brushing and cleaning its forehead and eyes with its hairy palpi, just in the way that a cat acts with its fore-paws for a similar purpose. Many spiders show great attachment to their eggs and young; the female *Lycosa* will do battle for her egg-cocoon until apparently convinced of the uselessness of continuing her attempts to regain it. Many, also, of the genus *Clubiona*, as well as others, brood over and tend upon their young, until growing up they disperse to find their own means of subsistence. It is not meant, however, that the young are fed by the parent, for very young spiders probably exist almost solely for a time on the moisture imbibed from the atmosphere, though at a very early age young Epeïrides may be seen catering for themselves among the smaller prey of insects caught in the parental snares.

III.—MODE OF SEARCH AND CAPTURE.

With regard to the search for spiders and their capture, it might almost be sufficient to say *search everywhere*, and *capture in every possible* or *practicable way;* but still it may be useful, as the result of experience, to make a few more detailed remarks upon those heads. There is scarcely any conceivable locality but what some species or other of spiders may be found in it, and, therefore, none should be set down *à priori* as unlikely, or not worth a close examination; among many other favourable localities, however, may be mentioned particularly *loose bark of trees*, under which numerous species conceal themselves by day, and many others dwell entirely, forming underneath it their snares and egg cocoons; *beneath stones* and *detached pieces of rock* myriads of spiders dwell; in this habitat are found many of the Drassides, a numerous and, though generally plainly coloured, exceedingly interesting group; *among rubbish* and *heaps of débris, wood, brickbats*, or what not, *beneath* and *among cut grass* and *rushes* or *reeds* which have lain some little time after cutting, also

among grass or other herbage, *near its roots*, numerous species—seldom to be seen and rarely procured elsewhere—live and secrete themselves; also, among *mosses*, *lichens*, and *dead leaves* may be found many minute spiders not to be obtained except by a careful search among such materials. *Water-weeds* and *débris*, collected in *marshes* or on the *borders of ponds and streams*, are also most favourable for the hiding places and habitations of many peculiar species seldom found in other localities. I have not mentioned such obvious habitats as trees, bushes, blossoms of flowers, the general surface of the earth, rocks and stones in every locality, houses and old buildings of all kinds, outer walls of houses, palings, tree trunks, etc., etc.; in all these spiders force themselves upon the collector's attention, but, in the others before-mentioned, they must be searched for carefully, and often painfully. Some spiders again (though of small size) are *quasi-parasitic*, living on the outskirts of the webs of larger species. Those at present known consist of a single genus, or perhaps two genera, of which several species have been described, and others are known. They are of the genera before-mentioned—*Argyrodes* and *Ariamnes*. These inhabit the webs of large Epeïrids, and appear to live on the smaller insects caught in them; probably also spinning their own irregular snares among the larger lines of the geometric web. The webs, therefore, of large Epeïrids, especially of those which live in colonies like the *Epeïra opuntiæ* of Europe and Asia, should be searched very narrowly for these curious and beautiful little spiders, otherwise they, as well as their long-stemmed pear-shaped nests, will probably be overlooked, or perhaps considered to be only the young of the Epeïrides in whose web their domicile has been taken up. All the known species of this little parasitic group are more or less metallic in their colours and markings; their legs are long and very slender; the cephalo-thorax of the male is generally very remarkable in its conformation, and the abdomen also frequently takes some eccentric shape.

The search for spiders has this advantage over that for insects in general: spiders cannot escape by taking wing, though I have more than once lost a valuable but minute specimen which has floated away from me successfully on its silken line; but for the very reason that spiders are more sedentary, or often moving only on the surface of the earth, it requires perhaps greater diligence and attention to become a very successful collector of spiders than of insects. One rule the collector should observe as much as possible, and that is, not to capture spiders with the fingers if it can be avoided, for some spiders in tropical countries will inflict severe injury by their poisonous fangs, and others, especially minute ones, will receive injury to the delicate spines, as well as to the hairs and pubescence, upon which much of their colour and specific character often depends. At times, of course, where it is a question between losing and obtaining a specimen, the fingers must be used; and practice makes

perfect even in this mode of capture. It is often impossible to capture minute spiders quickly without wetting the finger and laying it lightly upon them. The spider adheres for an instant, during which the finger is applied to the open mouth of a bottle of spirits carried in the pocket, and the spider is at once immersed. When a spider is seized in the fingers it should always be an endeavour to get hold of it by at least two legs, for one leg would most probably be thrown off by the muscular power which spiders can exert at will, provided they have sufficient free motion. Collectors often complain of the brittleness of spiders' legs, but in most cases it results from the instinct of self-preservation, which teaches the spider to give up something rather than lose all. I have seldom found that spiders can throw off their limbs if held by two of them at once. An easy and good way of capturing spiders at rest is with a pill-box; the bottom in one hand and the lid in the other encloses them quickly and safely; for spiders running on the ground, or on walls or trunks of trees, an ordinary entomological hoop-net is most useful. The net is placed (if on the ground) in front of the spider, and with the disengaged hand it is easily guided or driven into the net, whence it must be boxed into a pill-box, like an insect. If the spider is on a wall (no easy place to capture a spider by any other means) the net is held underneath, and then with a twig in the other hand it is dexterously jerked or flipped off into the net. The moment a spider is seen on a wall, or tree trunk, or other similar situation, the net should immediately be placed beneath it, as many spiders drop off the instant that danger even approaches, and would probably be lost entirely if there were bushes or herbage, or rocky and broken ground below. The hoop-net is also most useful for beating bushes and boughs of trees into; but perhaps for this purpose, and for shaking moss, cut grass, and *débris* into, nothing is superior, or in fact equal, to a very large common (but strong) cotton umbrella—a regular Sarah Gamp. The hoop-net is, however, the best for sweeping amongst long grass, rushes, or herbage of every kind, for upon such spiders usually abound. Spiders which spin a geometric web very often live in it, or close by, and yet can seldom be secured unless as a preliminary the net or umbrella be placed well underneath before the examination of the web is begun, but by taking this precaution the tenant usually drops in and is secured at once.

According to some or other then of the above modes of capture, the spiders will be safely secured in pill-boxes of various sizes—but *never* more than one spider in a box, for obvious reasons; a drop or two of chloroform, allowed to run inside the very slightly opened lid, stupefies the inmate in a few moments, when it may be minutely examined, its colours noted, etc., etc., and then dropped into the wide mouthed bottle of spirit of wine carried in the pocket or tied to the button-hole by a short string. To preserve an accurate record of localities, etc., it is perhaps advisable to write a memorandum in pencil on

the lid of the pill-box at the time of capture, and to defer chloroforming and putting into spirits until the day's collecting is over, when notes may be entered from the lid of each box into the note-book at leisure. The spiders can then also be placed in separate tubes or portions of tubes of spirit, divided from each other by a small dividing layer of cotton wool, and each with a little number written on parchment, and slipped into the tube with it, referring to the numbered notes in the note book or collecting journal. In absence of chloroform, brimstone will stupefy spiders, or they may be placed over (but not in) boiling water. Spiders again may be (like Coleoptera) collected into a wide-mouthed bottle in which chopped laurel leaves or blotting paper slightly saturated with prussic acid have been placed, from which they can be removed and placed in spirit at the end of the day. Spiders of large size, especially those with soft and tumid bodies, preserve their form and colours best if kept prisoners for a few days without food in the pill-boxes; during this time they discharge a great deal of the crude contents of the abdomen, which would have rendered their ultimate preservation, even in spirit, doubtful.

IV.—MODE OF PRESERVATION AS CABINET OBJECTS.

Beautiful as are the colours and markings of numbers of spiders, especially of those found in the tropics, yet it is not easy to make good-looking, sightly cabinet objects of the Araneidea; and hence, perhaps, more than from any other cause, this order is, in comparison with the insect orders, almost wholly neglected. It is possible, however, to display a large proportion of them very satisfactorily, if care and dexterous manipulation are used. This may be effected in more than one way. Many species, whose abdominal integument is strong, and pretty thickly clothed with hairs, or hairy pubescence, may be pinned, dried, and set out like insects; the abdomen may in some cases be simply opened from beneath, and after the contents are extracted stuffed with the finest cotton wool; others may have the abdomen inflated with a blow-pipe after its contents have been pressed out, and then rapid drying prevents the obliteration of colour and markings. But the best way to preserve both colour, markings, and form, for scientific purposes (and with some little extra care and trouble, for cabinet objects also), is to immerse and keep them in spirit of wine, or other strong spirit. The late Mr. Richard Beck, of 31, Cornhill, London, communicated to me a method of preserving spiders in spirit, by enclosing them within a flat under-glass and a concave upper one, the two being cemented together with gold size. The spider has to be set out (in spirit) in a natural position, until the limbs are tolerably rigid; it is then laid on its back in a thin concave glass, like a watch glass—this glass must be sufficiently large just to receive legs and all without cramping them, and deep enough to allow the spider just to be free, when a flat glass is laid on the

concave one. When the spider is laid in such a glass on its back, the glass is as nearly as practicable filled with spirit, and the flat glass which may be square and a little larger all round than the other, is *sized* down upon it. The spider may then be seen in every direction, and it looks, in fact, like a living creature swimming inside. The objections to this mode are its comparative costliness, and the impossibility of avoiding the inevitably enclosed air-bubble; as regards the latter, however, its presence might be rendered harmless by slightly tilting the whole in the cabinet drawer; this fully presents the spider to the eye, and frees it also from contact with the air-bubble. Spiders, however, so preserved are sealed up from all higher scientific purposes, such as the minute examination, under a strong lens, of special portions of structure, and their often necessary dissection.

Another mode, which I have practised successfully myself, is far easier, less costly, and leaves the spider free for any scientific investigation, while it is yet made a pleasing object for ordinary observers. My *modus operandi* is first to catch the spider in a pill-box; it is then rendered motionless in a minute or two by a few drops of chloroform allowed to run into the box through the slightly opened lid; when perfectly insensible it is set out and secured in a natural position on a piece of wood or cork, by means of pins placed wherever needed (except *through* any part of the spider); the whole is then placed in a shallow jar, deep enough, however, to allow of sufficient spirit being poured in to cover the spider completely; the jar is then covered over, and allowed to remain undisturbed until the limbs have become sufficiently rigid, by the action of the spirit, to allow of the removal of the pins without affecting the natural position of the spider; this will take place in a week or ten days, more or less, according to circumstances; the longer it is allowed to remain, the less chance there is of the legs curling up afterwards. When removed, after the limbs have become rigid, the spider is put carefully, with the fore-legs downward, into a test-tube just large enough to admit it freely, without unduly compressing the legs, the tube having previously had a slip of white card-board inserted into it, exactly the width of the diameter of the tube, and about three-fourths of its length; this slip of card is to form a back-ground to the spider, and to keep it steadily in one position; the tube is then filled perfectly full of clean spirit of wine, a parchment label containing the name of the spider is inserted in an inverted position, so as to coil round next to the glass, just above the spider, and the tube's mouth is pretty firmly stopped with a pledget of cotton wool, after which it is placed, wool downwards, in a broad-mouthed, glass-stoppered bottle, large enough to contain from five to fifteen, or so, tubes, when ranged within in a single row close to the glass, and kept in place by the whole vacant centre being firmly filled in with cotton-wool; the glass-stoppered bottle thus packed, is then filled up nearly to the brim

with spirit, making it impossible for that in the tubes to evaporate until the whole of that in the bottle has evaporated, which, if the glass-stopper fits pretty well, will not be for several years. In each tube two or more specimens —male and female—may be placed, one above the other, according to the length of the tube, and some specimens are placed so as to shew the upper, and others to shew the under-side. When bottles so filled are arranged on narrow shelves not too far from the eye, they have a very neat appearance, and allow the spiders to be seen through the two glasses easily and perfectly—of course, the bottle must be taken in hand to examine the contents at all closely, and must be turned round to bring those spiders on the opposite side into view. For critical purposes, any tube may be taken out, and the spiders themselves removed from the tube without injury or difficulty, and as easily replaced; it is only necessary to use a pair of fine pliers with which to handle the specimens, and a pair of longer and larger ones, with oval cork or silk-padded points, with which to put in the tubes or remove them from the bottles. The label with the spider's name on it can be easily read through both the tube and bottle, if put in so as to coil closely round the inside of the former, which is, with very little practice, a simple matter to effect. The advantage of having the label *inside* is obvious; for it cannot then be rubbed off by external friction, and it can be removed and replaced at pleasure.

After many trials of different ways of managing test-tubes of spirit in which spiders have been placed, I can at last pronounce the above plan to be almost entirely satisfactory. When stopped with corks, and laid or kept upright in drawers, the spirit was quickly and constantly evaporating, requiring frequent re-filling; besides which, the corks soon became rotten with the action of the spirit, and not only allowed that in the tube to evaporate, but also, often breaking in removal, caused considerable trouble, and sometimes damage to the specimens, in getting out the portion left in the tube. Another evil has also vanished by the use of wool pledgets instead of corks, and that is, the occasionally serious cuts to the fingers from the sudden breakage of the tubes in corking. As the greater part of my own collection is intended for purely scientific purposes, I only take the trouble to set out here and there a specimen for the delectation of unscientific or "goodness gracious" friends; for when set out they occupy, of course, far more space in a tube than when put in just as they happen to come out from the effects of the chloroform or other stupefying agent. A single tube will often thus contain up to twenty or more examples unset, but never more that one species in a tube, and often only one sex. In all cases the name of the species, or a number written on parchment, should be placed in each tube, as above described. Glass-stoppered bottles, containing inverted wool-stopped tubes of unset spiders, may be filled quite full of the tubes, since there is no object in

merely ranging them round next to the glass, as recommended when the spiders are set out in a natural posture; any tube must therefore, in this case, be taken out before the contents can be examined. The numbers and names, however, of the spiders contained in the bottle are known at a glance, by being written at length on a paper, and gummed upon one side of the bottle, and so, being turned outwards on the shelf, it is legible without any necessity of handling. The sizes of the test-tubes and outer bottles required will vary. I am now using (and finding more handy and convenient than any others of the latter) strong, wide-mouthed phials (corked, but of course glass-stoppered ones would be preferable, though much more costly) of the following sizes :— ½oz., 1oz., 2oz., and 4oz.; these are kept in stock by most chemists'-bottle dealers, and may be had at a very reasonable price. The tubes vary from an inch and a half long, and from the size of a large straw mote to three inches long, and these are not too large to go into the mouths of the 2oz. and 4oz. bottles, but are yet large enough to contain the largest tropical spiders, except the comparatively few giants of the families Theraphosides, Thomisides, and Epeïrides; these latter may be put into the bottles without the intervention of any tube. When thus preserved, and arranged on narrow shelves, according to their systematic position, a collection of spiders is by no means an unsightly object, and its contents are almost as easily got at for reference and examination as the contents of most insect cabinets.

Description of the two Spiders, Macrothele huttonii, *sp. n.*, *and* Cambridgea fasciata, *L. Koch, selected to illustrate the structural details given in the foregoing pages.*

Family THERAPHOSIDES.
Sub-family *Theraphosinæ.*
Genus *Macrothele*, Auss.
Diplura, Koch ad part.
M. HUTTONII, sp. nov.
(Plate VI., figs. 14—19.)

I have been induced to describe and figure here the above species (*M. huttonii*) as not only illustrating well the different structural points of spiders noted in the foregoing pages, but also as itself being a spider of an entirely different type of form and structure from *C. fasciata* (described post). It is, as far as I can ascertain, of an undescribed species, and it is with much pleasure that I have connected it with the name of Capt. Hutton, from whom I received it, and to whom I am so deeply indebted for many other valuable and interesting examples of New Zealand spiders.

The following is a detailed description of *M. huttonii* :—

Adult male; length, 8·5 lines.

Cephalo-thorax broad oval, slightly squared (or truncate) at each end, depressed above, with but slight hinder slope, and little lateral compression forwards; the normal furrows and indentations are strongly marked; that indicating the junction of the caput and thoracic segments is large, deep, and of a circular form. It is of a clear and uniform yellow colour, with some marginal rows of short, and not very strong, dark hairs; a few of the same are also on the hinder slope, and a single row runs from between the eyes of the hind central pair to the thoracic junction.

The *Eyes* are on a very slight eminence close to the fore margin of the caput (the height of the clypeus being equal to the diameter of one of the four central eyes), and are in a position common to numbers of the Theraphosides. They are in two curved rows, or perhaps they may be better described as follows: two round, dark-coloured ones occupy the middle of the fore part of the slight eminence mentioned; these are separated by an interval of rather less than the diameter of one of them, and on either side is a group of three other eyes of a pearl-white colour, in a triangular form; but though rather close to the round eye on its side, and to each other, they are none of them contiguous with the other. Looking at the eyes as in two transverse rows, the two hind centrals are wide apart, the interval being nearly equal to the length of the line formed by those of the fore central pair; the form of the hind centrals is also somewhat quadrate; that of the eyes of the lateral pairs is oval. The fore laterals are largest, obliquely situated, and each is separated from the fore central nearest to it by an interval equal to that which divides it from the hind lateral on its side, which is also oblique, and very near to, but not contiguous with, the hind central nearest to it.

The *Legs* are strong, and moderately long, but not greatly differing in length—apparently their relative length is 4, 3, 1, 2. Those of the first pair are much the strongest, and have the tibiæ and metatarsi inordinately developed; the former are of large size, and somewhat oval, tumid form, and are armed with numerous not very long, but strong, bluntish-pointed black spines beneath the fore extremity, and on the inner side. The metatarsi are strongly bent downwards, and have a somewhat angular enlargement beneath their fore extremity. The legs, generally, are armed with spines, and furnished pretty thickly with hairs; each tarsus ends with three claws, but there is no scopula beneath them, which negative character appears to be the only good distinction from the genus *Diplura*, Koch. The colour of the foremost pair is a deep, rich reddish, chestnut-brown; the rest are of a greenish yellow-brown, the different joints, except the tarsi and metatarsi, being longitudinally banded with a darker hue.

The *Palpi* are moderate in length and strength; they are of a greenish yellow-brown colour, and furnished with long hairs chiefly on the radial

joints. The radial is about double the length of the cubital joint, and decreases a little in strength gradually from its hinder to its fore extremity. The digital joint is of a somewhat oval form, broadest in front, where it is notched or strongly indented. The palpal organs consist of a simple pyriform corneous bulb, its stem tapering to a point, curved, and directed outwards and backwards.

The *Falces* are moderate in strength, roundly prominent, and of rich chestnut-brown colour, furnished with bristly hairs in front.

The *Maxillæ* are strong and divergent, the extremity of each, on the inner side, is slightly produced into an obtusely prominent point.

The *Labium* is short, and of a somewhat semi-circular form. These parts are of a brownish-yellow colour.

The *Sternum* is not large ; it is broader behind than at its fore part, hairy, and of a greenish yellow-brown colour.

The Abdomen is rather large, oval, and moderately convex above ; it is of a blackish-brown colour, mottled and marked with pale whitish drab-yellow, and an indistinct pattern may be traced showing a longitudinal central tapering dark bar, from which on either side several broadish, pale, and slightly oblique bars run off to the sides. The upper-side is furnished with numerous long tapering bristly hairs, each springing from a minute black spot. The four large spiracular plates on the under-side are yellow, with a large patch of black brown on each. The spinners are four in number ; those of the superior pair are tapering, nearly as long as the abdomen, and consisting of three joints of nearly equal length ; they are hairy, and of a greenish yellow-brown colour. Those of the inferior pair are small, one-jointed, and not more than half the length of a single joint of the superior pair.

An adult female agreed substantially with the above description of the male, except in being rather larger and wanting the abnormal form and development of the tibiæ and metatarsi of the legs of the first pair, and, of course, differing also in the structure of the palpi, which, in this sex, are simply pediform, and terminate with a single strongish, rather blunt-pointed, curved claw, armed beneath with (apparently) a single tooth towards its base.

An adult of each sex of this spider was received from Captain F. W. Hutton, by whom they were found at Wellington, New Zealand.

Family Agelenides.

Sub-family *Argyronetinæ*

Genus *Cambridgea*, L. Koch.

C. fasciata.

Cambridgea fasciata, L. Koch, Die Arachniden Australiens, pp. 358—361, pl. xxviii., fig. 2.

(Pl. VI., figs. 1—13.)

An adult female of this spider was contained in a small collection made in

Canterbury, New Zealand, several years ago, and kindly given me by Dr. Ll. Powell, of Christchurch, N.Z. In a subsequent collection from Waikato, N.Z., kindly sent by Captain Hutton, there were one or two others (females also) of the same species. Upon one of these (a very small example) the above new genus was founded by Dr. L. Koch, to whom I had transmitted the specimen for examination. More recently still, Captain Hutton has forwarded me an adult male and female of it found by Mr. H. H. Travers at the Chatham Islands, N.Z. The adult male nearly resembles the female in colours and markings, but is very much larger than either of the females I have yet seen, and differs from them notably in the development of the falces; in fact, the whole spider affords such a good example of the different points of detail in the general structure of the *Araneidea*, that I have decided to figure it in the present instance for the purpose of illustrating the structural features of spiders remarked upon in the previous pages.

With regard to the genus *Cambridgea*, founded upon this species by Dr. L. Koch, I was at first rather doubtful myself as to its distinctness from *Argyroneta*, Latr.; as, however, that able author still adheres to his opinion on the point, I have given this spider here under the generic name which he has done me the honour to confer upon it, though not having myself yet been able to compare it critically with *Argyroneta*. The following are the measurements of the different examples that have as yet come under my notice :—

Female adult (type of genus and species),				Waikato, N.Z.; length, 3·5 lines.
,,	,,	,,	,,	Waikato; length, 5 lines.
,,	,,	,,	,,	Canterbury; length, 7 lines.
,,	,,	,,	,,	Chatham Is.; length, 8·5 lines.
Male adult	,,	,,	,,	Chatham Is.; length, 10·5 lines.

This great variation in size is also a strong character in the genus *Argyroneta;* as also are the development of the falces in the male, and the existence of the supernumerary spiracular orifices indicated in f. 2*tt.*, and f. 3*p*.

The following is a detailed description of the male :—

Cephalo-thorax oval, moderately convex above, constricted laterally forwards, and rather truncate at its fore extremity; it is of a light reddish-yellow brown colour, with a broad lateral band of a much deeper hue on either side, and also a similar longitudinal central one, divided almost throughout its length by a fine light reddish-yellow line. The height of the clypeus, which is nearly vertical, is less than half the facial space; the surface of the cephalo-thorax is thinly clothed with fine adpressed light-coloured hairs, with a few prominent bristles in the ocular region.

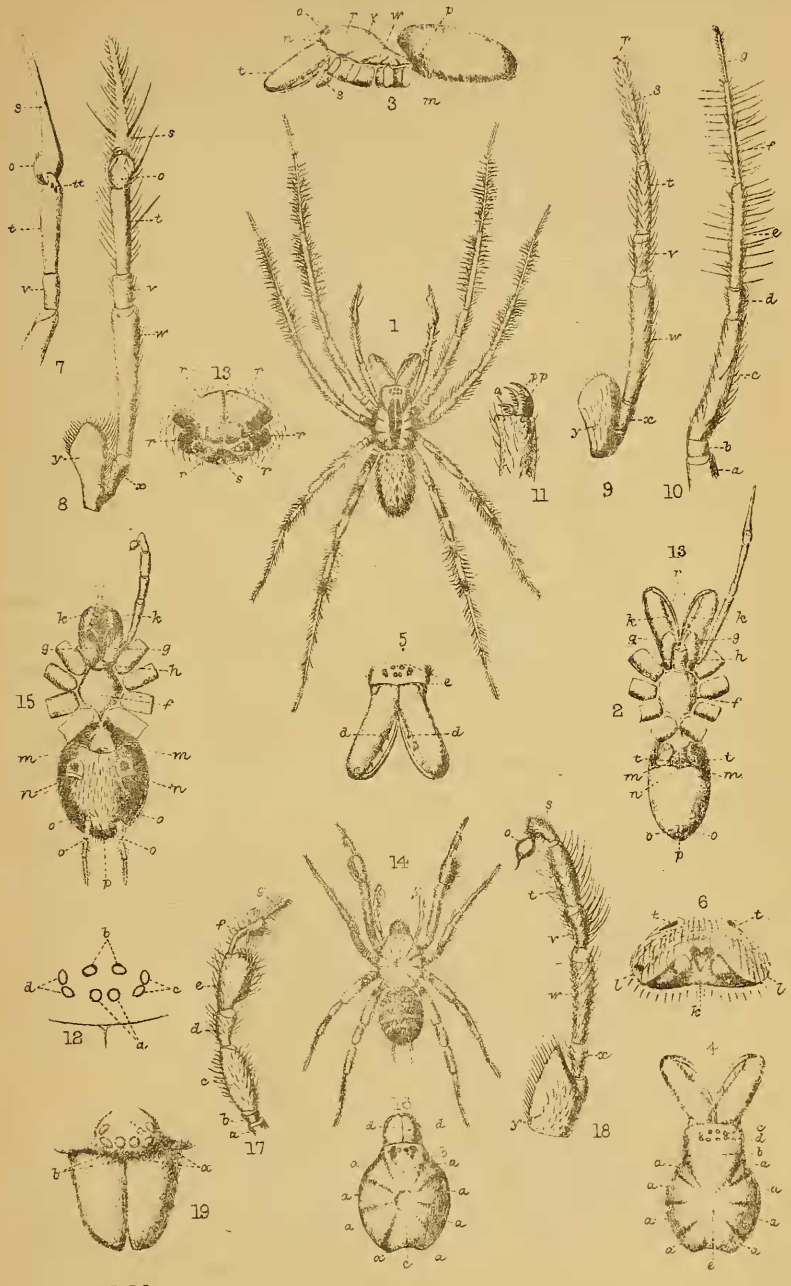
The *Eyes* are of tolerable size, but scarcely differing from each other in that

respect. They are in two curved rows, forming a transverse oval figure, about double as long as it is broad at its broadest diameter. The eyes of the hinder row are equi-distant from each other. The fore central eyes are rather nearer together than each is to the lateral of the same row on its side. Those of each lateral pair are seated slightly obliquely on a not very prominent tubercle, and are near to each other, but not contiguous.

The *Legs* are long and tolerably strong; their relative length is 1, 2, 4, 3, and they are furnished with spines (not very long nor strong), and with numerous—some nearly erect—hairs of different lengths. The colour of those of the two foremost pairs is yellow-brown, the femora and genuæ being darker than the rest, and with a very faint indication of a paler annulation both on the femora and tibiæ. The two hinder pairs are similarly coloured, but have two distinctly marked yellow annulations on each of the femoral and tibial joints; each tarsus terminates with three curved claws; the superior ones pectinated beneath the hinder half; the inferior one much the smallest, and strongly bent downwards near its base, where it has one or two teeth.

The *Palpi* are rather long and slender; they are of a reddish-yellow brown colour, the basal part of the radial joint being pale yellow brown, shading off into the redder part. The humeral joint is bent inwards; the radial is more than double the length of the cubital joint, and rather strongest at its fore extremity, near the outer side of which are two small apophyses; that nearest the base of the digital joint is the largest, of a flattened form and truncate extremity, the other (behind it) is sharp pointed, and of a somewhat tooth-like form. There is also a small prominent point beneath the larger apophysis above-mentioned. The digital joint is small, oval, but its extremity is greatly produced in a long cylindrical form, being a greatly exaggerated example of a somewhat similar form in *Argyroneta* and *Tegenaria*. The length of the digital joint considerably exceeds that of the radial and cubital together, being about equal to that of the humeral joint. The palpi, like the legs, are furnished with a few slender spines and long hairs; of the former are several longish conspicuous ones on the digital joints. The palpal organs are contained within the oval basal part of the digital joints; they consist of a simple whitish oval lobe, with a red-brown corneous lateral margin, probably an independent, though closely adhering, spine, but this I could not ascertain satisfactorily; there are also a sharp-pointed dark red-brown spine on their inner side, and a stronger obtuse corneous projection near their extremity, and a small one on the outer side.

The *Falces* are long, strong, divergent, and projecting forwards; their length is very nearly equal to that of the cephalo-thorax; the fangs are long and strong, and beneath them are several strong sharp teeth along the inner side of the falces, which are of a deep rich reddish chestnut brown colour, and



A.T. Hollick. del.

furnished above with short strongish hairs; the fangs are of a still darker hue than the falces.

The *Maxillæ* are strong, straight, enlarged at their extremities, where they are rounded on the outer, and obliquely truncated on the inner-sides, the inner edges curved somewhat over the labium, which is of an oblong form, deeply notched or hollowed out in a circular form at its apex; these parts, as well as the sternum, which is of ordinary form, are of a dark red-brown colour, the labium being rather the darkest. The maxillæ are furnished with strong bristly hairs; those on the inside, and beneath their extremities, forming strong tufts. The labium and sternum are also furnished with hairs, and these are less strong than those on the maxillæ.

The *Abdomen* is of moderate size and oval form. Its fore part (looked at in profile) is high, and slopes gradually to the hinder extremity; the upper part and sides are of a dull yellowish colour, marked chiefly on the sides and outer edges of the upper part with black-brown spots and short striæ. There is also, on the fore part of the upper-side, an indication, by means of a dark, irregular margin, of a longitudinal central oblong marking, pointed at its hinder extremity, and with an obtusely angular prominence near the middle of each side—the hinder part of this marking is followed by other dark, irregular markings to the spinners. The under-side is suffused with dull brown, laterally bordered with a yellowish, ill-defined stripe, along which is a row of small, rust-red spots; there appears to be some variation in the markings on the upper side, one female being far more marked with black-brown, and having some oblique pale stripes on the sides. Besides the ordinary spiracular openings, there is, on either side, another narrow, reddish slit, or opening, a little above the usual one when the spider is looked at in profile (f. 3*p*). Also, between the large spiracular plates or opercula are two other still smaller openings of a reddish hue (f. 2*tt*), all of which probably open into spiracular tracheæ. These openings have been observed also in *Argyroneta;* and in the Drassoid genus *Anyphæna* analogous ones have been found between the ordinary spiracular plates. The spinners are very short; those of the inferior pair being the strongest, and of a paler hue than those of the superior pair.

The colours of the female are clearer, and the markings better defined than those of the male above described; their general character, however, is tolerably similar. The figure given (*l.c. supra*) by Dr. L. Koch, of the female, is excellent. I have not been able to learn anything of the habits or economy of this fine and remarkable spider.